REMARKS

Claims 1-28 are pending.

Information Disclosure Statement

The Examiner asserts that the Information Disclosure Statement filed January 9, 2007 failed to include a copy of "Optophysical Property Handbook." Applicants respectfully disagree.

A partial translation of the "Optophysical Property Handbook" (1984) (page 184, line 15-page 185, line 3) was submitted with the Information Disclosure Statement dated January 9, 2007 (and resubmitted herewith). A search of the Image File Wrapper shows that the PTO scanned in the partial translation as part of the Katayama et al. reference. Accordingly, Applicants respectfully request the Examiner to return initialed Form PTO/SB/08 indicating that the reference has been considered.

Response to Objections to the Specification

(1) The title of the invention was objected to as being non-descriptive.

The title of the invention has been amended as suggested by the Examiner. Accordingly, withdrawal of the objection is respectfully requested.

(2). Paragraph [0009] has been objected to because the Disclosure includes a reference to patent 3,078,611, but does not include a country code.

Paragraph [0009] has been amended to recite the proper country code and reference to the publication number. Accordingly, withdrawal of the objection is respectfully requested.

(3) Paragraph [0036] (Applicants believe the Examiner meant to refer to paragraph [0024]) has been objected to because the carrier concentration (lower limit) in the disclosure differs from that recited in the claims.

Paragraph [0024] has been amended to correct the discrepancy. Accordingly, withdrawal of the objection is respectfully requested.

Response to Claims Rejection Under § 103

Claims 1-28 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Dimitrova et al (V. Dimitrova, J. Tate, Synthesis and characterization of some ZnS-based thin film phosphors for electroluminescent device applications, Thin Solid Films 365 (2000) pages 134-138, hereinafter "Dimitrova"). Applicants respectfully traverse.

(1) Polarity:

Dimitrova relates to a phosphor material composed of ZnS:$CuCl_2$. However, Dimitrova does not disclose or suggest the features of the claimed p-type semiconductor. In particular, Dimitrova discloses the resistivity of the phosphor material, but fails to disclose or suggest the material's polarity, an important feature of semiconductor materials.

In Dimitrova, Cl is added with Cu as a dopant of ZnS and thus, the thin film composition is:

$$Zn_{1.03}S:Cu_{0.05}Cl_{0.008}$$

See, p.136, line.9. Accordingly, the Cu concentration is more than six times higher than the Cl concentration, but the Cl activity as a dopant is more than ten times higher than that of Cu. Thus, Dimitrova discloses a material having n-type conductivity, and therefore fails to disclose or suggest the p-type semiconductor material of the present invention.

(2) Composition:

In addition, the thin film composition of Dimitrova is produced by co-evaporating ZnS powder and $CuCl_2$ powder, and as such, Dimitrova's composition is not expected to attain a stoichiometric composition. However, the presently claimed material satisfies the stoichiometric

relationship wherein the number of Zn + Cu + A + B atoms equals the number of S + Se + Te atoms. Thus, the composition of the presently claimed material differs from that of the thin film composition of Dimitrova.

(3) Function of Cl Dopant:

According to the present invention, the presently claimed semiconductor material makes it is possible to regulate the resistivity by using a compensation dopant, Cl, (a compensator) in addition to a Cu doping amount. The regulation of the resistivity is a technique which can be utilized for regulating a carrier balance and adjusting a hole – electron recombination position when a homojunction to an n-type or intrinsic ZnS based semiconductor and a heterojunction to another semiconductor material are formed to constitute a semiconductor device. In other words, in cases where it is difficult to control the density of the electron hole merely by changing the Cu concentration, it is possible to precisely control the carrier concentration by doping a compensation dopant such as Cl. *See,* paragraphs [0020] and [0021].

In contrast, the method of doping Cl according to Dimitrova is a method typically used for a phosphor material. In particular, Dimitrova discloses that, in the case of $ZnS:CuCl_2$, Cu and Cl are co-activators. Thus, when the Cu level is formed on the top of a valance band and the Cl level is formed on the top of a conductor, as in Dimitrova, light corresponding to the differences in energy between the two levels is generated. Accordingly, Dimitrova fails to disclose or suggest a method of precisely controlling the carrier concentration.

(4) Quantity of Cl Dopant:

Further, the present claims recite a concentration of the compensation dopant (Cl, etc.) of 10^{17} to $10^{20}cm^{-3}$, which is equivalent to a Cl concentration of 1.98e-4 to 0.198 [at.%].[1] In contrast, Dimitrova discloses a Cl concentration of 0.37 ± 0.01 [at.%].

Thus, Dimitrova fails to render obvious the present claims. Accordingly, withdrawal of the rejection is respectfully requested.

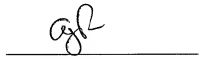
In view of the above, reconsideration and allowance of this application are now believed to be in order, and such actions are hereby solicited. If any points remain in issue which the Examiner feels may be best resolved through a personal or telephone interview, the Examiner is kindly requested to contact the undersigned at the telephone number listed below.

[1] Although the lattice constant is slightly different, the concentration of the compensation dopant (Cl, etc.) of 10^{17} to $10^{20}cm^{-3}$ can be converted to a unit of Cl concentration in Dimitrova follows:

- lattice constant: a=5.409[Å], cubic structure
- lattice volume; V=158.279 [$Å^3$] =0.158279[nm^3]=0.158279e-27[m^3]
- number of Zn and S atoms included in lattice per unit: Zn_4S_4=8
- number of atoms per $1cm^3$=8/(1.527279e-27)=5.05e+28 [number/cm^3]
  =5.05e+22 [number/cm^3]
- Compensation dopant concentration of the present invention:
  1e+17 to 1e+20 [number/cm^3]
- Cl concentration [at.%]=Cl/(Zn+S)
  = (1e+17/5.05e+22)x100 to (1e+20/5.05e+22)x100 = 1.98e-4 to 0.198 [at.%]

The USPTO is directed and authorized to charge all required fees, except for the Issue Fee and the Publication Fee, to Deposit Account No. 19-4880. Please also credit any overpayments to said Deposit Account.

Respectfully submitted,



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